The Mere Presence of a Cell Phone and Academic Ability

by

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Abstract

Prior research has suggested that cell-phone use in the classroom and during learning-related tasks is detrimental to academic performance. Recently, the mere presence of a cell phone has been found to negatively affect relationships and to impair performance on learning and cognitive tasks. The present study explored whether the presence of a cell phone hinders performance on tests that measure pre-existing academic ability. In total, the study evaluated 45 participants who were enrolled in an introductory psychology course at Mount Royal University or who were members of the general public. Three subtests from the Wide Range Achievement Test (WRAT-4) were completed: spelling, sentence comprehension, and mathematics. During testing, half of the participants had their cell phones present and the other half did not. Statistical analyses revealed that when a cell phone belonging to a participant was merely present, there was no statistically significant difference in the demonstration of pre-existing skills on the sentence comprehension ($p = .52$), spelling ($p = .07$), and mathematics subtest ($p = .11$) compared to when a cell phone was removed. Unexpectedly, a non-significant trend was observed in the opposite direction; that is, the cell-phone-present group outperformed the cell-phone-absent group on all of the subtests.

Keywords: mere presence, cell phones, academic ability, achievement

The Mere Presence of a Cell Phone and Academic Ability

Electronic devices such as cell phones are ubiquitous in academic settings nowadays, and classes are filled with students and instructors who use and carry these devices around regularly (Baker, Lusk, & Neuhauser, 2012). Simply walking along a corridor on the way to a lesson, before even setting foot in a classroom, almost always leads to multiple sightings of technology. Baker et al. (2012) surveyed faculty and students about perceptions toward technology use; at that time, 99% of participants reported owning a cell phone. As the use of cell phones becomes more prevalent, connecting with someone whenever and wherever is easier than ever before (Ito & Kawahara, 2017). Everyday norms are rapidly evolving, thereby making the use and presence of cell phones more accepted and frequent compared to previous eras (Crowley, Allred, Follon, & Volkmer, 2018).

The use and presence of cell phones are not equally acceptable everywhere or to everyone, so policies related to technology use and presence in the classroom can vary. Campbell (2006) surveyed faculty members and students about their perceptions toward cell-phone use in the classroom; the respondents generally agreed that cell-phone rings disrupted learning, and classroom policies were needed to curb excessive technology use. Students (from about age 18 to mid-20s) reported higher acceptance of cell-phone use (e.g., attending to a ringing phone during class), and were more resistant to technology policies, compared to faculty members (Campbell, 2006). Some instructors have added technology policies to course outlines (Bugeja, 2007), and some academic institutions have created technology policies to guide faculty and students in what is considered appropriate cell-phone use in a classroom (Baker et al., 2012). Despite efforts to develop

policies that limit or restrict technology use, little is known about how technology in the classroom affects academic skills and ability or what policies to create and enforce. Due to the lack of information about the relationship between technology policies and learning, the mere presence of cell phones (i.e., when phones are physically present, but not in use) in the classroom is an important topic to investigate. Before discussing the mere presence of cell-phone technology, one area that must be addressed is as follows: the effects of cell-phone use on individuals in learning contexts, within classroom environments, or during learning and procedural tasks.

Cell-Phone Use

Detrimental effects on academic performance. Given the high rates of cell-phone ownership, researchers have started to take an even greater interest in studying cell-phone use in academia. Two studies, one employing survey methods (Harman & Sato, 2011) and the other amalgamating survey and experimental methodology (Froese et al., 2012), provide thought-provoking evidence for cell-phone use related to lowered achievement. Harman and Sato's (2011) survey asked students to report grade point average (GPA) and year of study to see how these factors correlated with cell-phone use. First, the more participants reported sending and receiving text messages throughout the course of a day, the lower their reported GPA; secondly, the further along participants were in their program, the less often they sent, received, or checked their cell phone for inbound messages (Harman & Sato, 2011). A year later, in the first of two related studies by Froese et al. (2012), participants predicted how much learning would occur while texting during a presentation. Specifically, if texting was prohibited during class, participants predicted an average score of 8.93 on a 10-item test; on the other hand, if

texting was allowed, the predicted test average was 6.01 (Froese et al., 2012). In Froese et al.'s (2012) second study, a different sample was used to compare the predicted performance from Study 1 to the actual performance in Study 2; as expected, the more time participants spent texting, the lower they scored on a quiz that was completed after the presentation. In Study 2, when texting occurred, the average quiz score was 6.02; conversely, the average quiz score was 8.25 for the non-texting group (Froese et al., 2012). If survey-based studies have shown that academic performance declines with high rates of cell-phone use, similar detrimental effects might be found in research employing solely experimental methods without surveys.

Experimental studies have supported the notion that cell-phone use disrupts learning and diminishes academic performance. In an experimental condition, End, Worthman, Mathews, and Wetterau (2010) manipulated a cell phone to ring twice during a video presentation and notetaking task; in contrast, they did not manipulate a phone to ring in the control condition. Afterward, to gauge the lecture information participants attended to, the notes from each condition were compared, and academic performance was assessed on two multiple-choice test items pertaining to content delivered during the time of the cell-phone rings (End et al., 2010). Participants who experienced the phone rings recorded less relevant information in their notes and performed more poorly on the two test items containing content presented during the ringing. In a different study, Kuznekoff and Titsworth (2013) manipulated the frequency (i.e., high or low) of texting or posting online; for their study, participants viewed a video about communication theories, took notes about the content while texting and posting frequently or infrequently about various topics (e.g., favourite restaurants or opinions about a photo), and then

completed a free-recall and multiple-choice exam. The more frequently participants texted or posted, the less information they recorded in their notes and the less material they recalled on the exams (Kuznekoff & Titsworth, 2013). In a more recent study, before reviewing self-chosen course material during a homework session, Cutino and Ness (2017) asked students to list course tasks and study goals that needed to be accomplished. During the session, students in the control condition were provided no instruction about cell-phone use, but participants in the experimental condition had their phones taken away (Cutino & Ness, 2017). After the session, Cutino and Ness (2017) found that students who had their cell phones removed reported accomplishing more homework tasks and study goals. The majority of studies to date have indicated that using a cell phone during education-related tasks affects learning. Limiting cell-phone use seems like a feasible solution to increasing academic performance, but cell-phone restriction has not always been advantageous.

Restrictions and the associated effects. The increase in anxiety levels resulting from cell-phone use restriction has been well-documented. In Clayton, Leshner, and Almond's (2015) study, participants completed two separate word-search tasks; one testing condition allowed for a personal iPhone to be visibly present during the task, and in the other condition the iPhone was removed but was close enough so participants could hear an unexpected, but simulated (i.e., made by the researchers) phone call. Ultimately, Clayton et al. (2015) observed elevated state anxiety (SA), blood pressure, heart rate, and feelings of unpleasantness when participants were separated from their ringing phones. Similarly, Cheever, Rosen, Carrier, and Chavez (2014) allowed participants to keep their cell phones out of sight and on silent mode, whereas in the other condition cell phones

were taken away. When cell phones were removed from participants' possession, Cheever et al. (2014) observed that anxiety increased, and participants who reported the greatest rates of cell-phone use experienced more anxiety with the passage of time compared to the less-frequent cell-phone users. In multiple studies, when restrictions were placed on participants who had a habitual tendency to check social networking sites, anxiety was also high (Rosen, Carrier, & Cheever, 2013; Rosen, Whaling, Rab, Carrier, & Cheever, 2013). Accordingly, if cell phone restriction is related to increased anxiety, cell-phone presence (i.e., when phones cannot be used) may be expected to have a similar effect.

Cell-Phone Presence

Cell-phone use has been widely studied over the last decade, but less is known about the effects of cell-phone presence. Recently, the mere presence of a cell phone has been studied in two domains: (1) relationships and (2) learning-related and cognitive tasks. Unfortunately, the research produced within the learning-related and cognitive task domain has been minimal, so the relationship domain provides a starting point which contextualizes the present study.

Communication and relationships. A few predominant studies in the research literature can elucidate how the mere presence of a cell phone has negative effects on relationships. Przybylski and Weinstein (2012) investigated relationship quality of dyads when cell phones were present. During a brief relationship-forming task, when a researcher's cell phone was merely present and the conversation topic was about a meaningful event (e.g., something that had occurred in the past year), relationship quality and emotions such as trust and empathy were reduced (Przybylski & Weinstein, 2012).

In 2017, Allred and Crowley expanded on Przybylski and Weinstein's research. They manipulated cell-phone presence to determine if conversation satisfaction was affected when discussion topics between two known partners (i.e., friends, romantic companions, or colleagues) were self-selected and when participants recalled cell-phone presence (i.e., researchers assessed if participants remembered a cell phone that was *actually* present or if they *recalled* a phone as present when it was not) (Allred & Crowley, 2017). When Allred and Crowley (2017) compared pre- and post-test conversation satisfaction, participants who *recalled* the presence of a cell phone, whether the phone was present or not, were less satisfied with the conversations than participants who did not recall its presence. Moreoever, Misra, Cheng, Genevie, and Yuan (2016) observed dyads in a naturalistic environment (i.e., a coffee shop). During these coffee-shop discussions, when participants held their cell phone in their hand or placed the phone on a table, empathetic concern and conversation quality decreased (Misra et al., 2016). Misra et al. (2016) also concluded that, when participants were in the presence of a cell phone, were well-known to each other, and had a close relationship, they reported less empathy. Finally, Lanette (2018) replicated Przybylski and Weinstein's (2012) methodology, but added a few additional components; she explored parent-teen interactions and cell-phone presence, and because Misra et al. (2018) did not utilize controlled interviewing techniques, Lanette (2018) conducted semi-structured interviews about cell phones and their relationship-damaging potential. When parents' phones and their teenager's phone were present, reported conversation closeness significantly declined (Lanette, 2018). In the aforementioned studies, cell-phone presence negatively affected social interactions;

unsurprisingly, the effects of cell-phone presence have been explored in learning environments and on learning-related tasks as well.

Learning and performance tasks. The mere presence of a cell phone has the power to affect in-person conversations; in fact, unfavourable consequences can occur during a variety educational, performance-related, and cognitively demanding tasks. A few years following Przybylski and Weinstein's (2012) intriguing research, Thornton, Faires, Robbins, and Rollins (2014) contributed their efforts to the cell-phone presence literature. They concluded that, regardless of whether a phone belonged to a student or to someone else, when a cell phone was merely present, attention was reduced and performance outcomes were poorer for complex tasks (Thornton et al., 2014). Correspondingly, Ito and Kawahara (2017) analyzed three main factors: phone presence, spatial attention to a phone (i.e., visual stimuli presented to a participant on the same or opposite side of the phone location), and attentional load using a small or large visual stimulus in a search task. Regarding spatial congruence, Ito and Kawahara (2017) determined there were no significant differences in reaction time on the search task when the phone was placed on the left or right side of the task stimuli. That is to say, the mere presence of a cell phone represented a general instead of a location-specific distraction (Ito & Kawahara, 2017). Overall, they discerned that when a phone was merely present and when attentional load was either high or low, reaction times were slower on the visual-search task (Ito & Kawahara, 2017). This suggested that phone presence may affect attention and lead people to work more slowly on a task than usual. Recently, Ward, Duke, Gneezy, and Bos (2017) studied the effect of cell-phone presence and low, medium, and high salience (e.g., cell phones kept on a desk, in a pocket/bag, or stored in

a different room, respectively) on working memory capacity (WMC), fluid intelligence (Gf), and cognitive capacity. Participants who had a cell phone in a highly salient place had significantly lower WMC, Gf, and cognitive capacity than participants whose cell phone was kept in a less salient location (Ward et al., 2017). Although these studies implied that phone presence has had unfavourable effects on learning, some replication studies have suggested otherwise.

Replication studies have indicated that cell-phone presence does not always impair task performance. A replication with extension of Thornton et al.'s (2014) study was done by Lyngs (2017), and there were two main differences: A photo-taking task was added to verify that cell phones were brought with participants on the day of testing and so the researchers could manipulate the phone's placement. Secondly, following a simple digit-cancellation task and a complex digit-additive task, participants in Lyngs's (2017) study completed an effort measure derived from Kurzban, Duckworth, Kable, and Myers (2013). This effort measure assessed "perceived opportunity costs" (Lyngs, 2017, p. 137). Based on this model, Lyngs (2017) hypothesized that people's performance is dependent on their level of interest in the task; as well, the mental effort required to focus on the task at hand directly corresponds to how appealing an external activity is. However, even though participants who reported high rates of cell-phone use rated the tasks as exciting and enjoyable, whether a phone was absent or present, there were no significant performance differences on simple or complex tasks (Lyngs, 2017). Nonetheless, Lyngs (2017) indicated that there is a need for larger samples and stimuli capable of detecting variability amongst participants. Stemming from this point, methodological issues may have actually contributed to the lack of significance. If a

replication study has suggested that the mere presence of a cell phone does not affect task performance, other research may show similar results.

One recent study examined the effects of cell-phone presence on attention and memory and discovered that cell-phone presence did not hinder task performance. In Urick, Egbers, and Sinell's (2018) study, participants were instructed to put away their cell phones (i.e., the phones were present, but not visible) or keep them visible while they completed three different online games and/or tasks: Concentration, Simon, and an n-back task. In the first task, participants flipped two cards over at a time, memorized the card placements as best as possible, and tried to match the card pairs as the game progressed (Urick et al., 2018). Urick et al.'s (2018) second online task required participants to repeat patterns that became increasingly longer over time. For the third task, when participants viewed an image, they indicated when the current image matched what they had seen two presentation trials before (Urick et al., 2018). When Urick et al. (2018) compared the task performance of the cell-phone present and absent groups, there were no significant differences in accuracy or completion time for any of the tasks. A small sample and possible fatigue effects may have contributed to the lack of significant findings (Urick et al., 2018). Even though researchers have developed various conclusions about the effect of cell-phone presence on individuals, predictions have been made for why this presence might be distracting in everyday life.

Cell-Phone Presence Hypotheses

Social connectivity. There are a few predictions for why the mere presence of a cell phone might pose a distraction to individuals, but one common thread occurs throughout the literature: social connectivity. Przybylski and Weinstein (2012) indicated

that cell phones can prime thoughts about social network interactions; as a result, individuals pay less attention to the present task, irrespective of what that task might be. In a similar manner, when a cell phone is merely present, it may distract individuals from the place they are currently in (Thornton et al., 2014). According to Misra et al. (2016), mobile devices act as a gateway; an individual may be in the presence of technology, yet psychologically someplace else. Based on Lyngs's (2017) thoughts and Kurzban's (2013) model, individuals may think about socialization opportunities while they are in the presence of their phone; this thought process requires a high amount of mental effort, which could lead to poor task performance (see Baddeley's 2012 article for an overview of working memory theory). Although much of the above research has expressed that access to social networks could increase distraction and temporarily remove someone (at least metaphorically) from the present, other researchers take a different stance. Faizi, El Afia, and Chiheb (2013) believe that the use of social networks improves students' and teachers' learning experience. Provided that there is some mixed debate, social networks can only partially explain why the presence of a cell phone might distract an individual from the task at hand. In light of this, dependence on cell phones and addiction to this technology are perhaps less obvious but equally important explanations.

Use, attachment, and dependence. Frequency of cell-phone use and attachment/dependence (i.e., on cell phones and to the Internet) are additional factors that need to be considered. In Thornton et al.'s (2014) study, participants completed a survey about cell-phone use and dependence; although older participants reported less attachment to and dependence on their cell phones, the researchers found that task performance was not significantly related to attachment or dependence. Nonetheless,

Thornton's study used self-reporting, so the results of these findings should be considered with caution. Ward et al. (2017) found that when participants who reported using their phones on a daily basis were in presence of a cell phone, they performed more poorly on various cognitive tasks. In addition, Ito and Kawahara (2017) used a measure of Internet addiction to determine participants' cell-phone dependence. When a cell phone was present, participants who reported the least amount of Internet use and attachment were significantly slower at a visual-search task (Ito & Kawahara, 2017). Ito and Kawahara (2017) suspected that slower reaction times were observed for the low Internet-use group because the cell phone represented a broad distraction, but the researchers also pointed out the difficulty of drawing conclusions due to a very small sample size.

The Present Study

Cell-phone presence and absence were manipulated, and participants demonstrated pre-existing sentence comprehension, spelling, and mathematics abilities. Based on prior research, deception, cell-phone visibility, and in vivo experimentation were all important aspects to consider.

Deceptive methodology. To avoid demand characteristics, researchers were required to produce some deceptive manipulations. For instance, Przybylski and Weinstein (2012) did not tell participants about a cell-phone presence or absence manipulation; before participants arrived for the study, a phone was placed on top of a book. In a different study, participants thought they were testing a new blood pressure device; rather, the researchers were investigating the psychological and physiological effects of iPhone separation (Clayton et al., 2015). Some studies were advertised to prospective participants as examining one topic, such as psychological factors related to

notetaking, but the researchers wanted to investigate a different relationship (End et al., 2010). In the present study, prior knowledge about a cell-phone presence or absence manipulation might influence the participants' responses. In effect, participants were not informed about the phone presence or absence manipulation until the debriefing. Also, to avoid suspicions about the true nature of the present study, the title (i.e., *The Mere Presence a Cell Phone and Academic Ability*) was publicised under a fictitious name (i.e., *Academic Ability*). Nevertheless, these were not the only deceptive methods required.

Seeing that the purpose in the present study could not be revealed too early, some additional deception was needed. In Thornton et al.'s (2014) study, near the beginning of a statistics lecture, participants were told to have their phones on their desks for a cell-phone-use survey; this survey was to be completed at the end of the class. The survey used by Thornton et al. (2014) was a façade so that the participants did not question why their phones remained on their desks during the completion of performance tasks. Comparably, in the present study some participants were told to have their cell phones on their desk for a survey about social media. Participants in the cell-phone-absent condition were told that their phones would be taken away but then returned later so they could complete a survey. In order to conceal the research question, participants were led to believe there was a survey when, in actual fact, there was no survey at all; this deceptive cover guaranteed random assignment and ensured participants brought their cell phones to the classroom.

Device visibility and location. Some researchers have suggested that when a cell phone is present and in a high-visibility area, it may be distracting or lead to increased anxiety (Sapacz & Clark, 2016; Ward et al., 2017). Sapacz and Clark (2016)

were interested in examining addictive properties of cell phones, and they examined factors and behaviours related to cell-phone use. After manipulating cell-phone visibility (e.g., taken away in a box, hidden in a pocket/bag, or directly in front of a participant on a table), an interesting result was found: Participants whose phone was in a high-visibility location (i.e., on a table) self-reported higher levels of state anxiety (SA) than participants whose phone was less visible or removed from the room (Sapacz & Clark, 2016). Sapacz and Clark (2016) suspected that when the phone was placed on a table, participants felt a strong desire to use the device when they were unable to do so. Furthermore, Ward et al. (2017) discovered that a reduction in cognitive capacity depends on cell-phone visibility. For example, the greatest reduction in cognitive capacity occurred when cell phones were placed on a desk, a medium reduction was observed when phones were stored in pocket or bag, and the least reduction in cognitive capacity occurred when phones were kept in a low-visibility location (i.e., a bag outside of the testing room) (Ward et al., 2017). In the present study, cell phones belonging to participants in a cell-phone-present group remained on a desk directly in front of them. For participants who were randomly assigned to the cell-phone-absent group, their cell phones were removed from their possession, and they thought that their phones were not in the room.

In vivo. Future studies can be conducted in naturalistic environments, and experiments can use realistic instead of artificial manipulations. In a partial replication of Przybylski and Weinstein's (2012) study, Crowley et al. (2018) noticed that when the confederates' cell phone was merely present during a relationship-forming task, there was no significant reduction in relationship quality or empathy. One explanation for this result might have been the confederates' prior practice with ignoring the phone;

consequently, further research on this topic requires more true-to-life manipulations (Crowley et al., 2018). Crowley et al. (2018) also implied that any cell phone that is present should belong to participants; that way, they are readily aware of the presence of a phone. Drawing upon this research, testing in the present study occurred in a classroom, and participants brought their own phones with them on the day of testing. Given this evidence, the present study made use of a naturalistic environment (i.e., a classroom), and participants in a phone-present condition were required to keep their phones in a usual place (e.g., on the top of a desk).

Gaps in the literature. In the relationship domain, a few key studies have been produced (Allred & Crowley, 2017; Crowley et al., 2018; Lanette, 2018; Misra et al., 2016; Przybylski & Weinstein, 2012). Within the learning-related and cognitive-task domain, some studies suggested that the mere presence of a cell phone impairs performance (Ito & Kawahara, 2017; Thornton et al., 2014; Ward et al., 2017). Other studies suggested that the mere presence of a cell phone may not impair task performance (Lyngs, 2017; Urick et al., 2018). The contradictory outcomes within these studies reveal that there are few definitive findings to suggest that cell-phone presence has either positive or negative effects.

Three issues arise from the learning-related and cognitive-task domain. First, because of conflicting results of the aforementioned studies, replication and replication with extension should be done. Secondly, future studies would benefit from larger sample sizes. For example, Urick et al. (2018) had fewer than 30 participants in their study; Lyngs (2017) performed a power analysis on Thornton et al. (2014), which revealed that he needed 66 participants for high statistical power (i.e., .80), but Thornton

reported less than that number (i.e., the highest number he recorded was 54). Thirdly, no one has directly investigated the influence that the mere presence of a cell phone has on previously learned skills and academic abilities.

Focusing on the learning-related and cognitive task domain, the most disconcerting problem appears to be the lack of research on prior skills and previous learning. For instance, Thornton et al. (2014) measured the number of lines completed and the number of correct answers on a digit-cancellation task, a digit-additive task, and two trail-making tasks. Rudimentary mathematics and language skills were the only academic abilities required for task completion, but Thornton did not assess whether participants' ability to utilize their previously acquired skills was impaired by cell-phone presence (Thornton et al., 2014). Lyngs (2017) replicated Thornton et al.'s (2014) study, but added an effort measure to determine how effortful, fun, boring, or exciting the tasks were. Again, the mere presence of a cell phone and its effect on pre-existing academic ability was never investigated (Lyngs, 2017). Ito and Kawahara (2017) investigated reaction times when participants completed a visual-search task with phones present, but the visual-search task did not require prior learning. Similarly, Urick et al. (2018) measured the duration and accuracy of participants' performance while playing online games and completing an n-back task. These games and tasks required minimal prior knowledge, skills, and academic abilities. Ward et al. (2017) used reaction times to assess attention on a go/no-go task. As well, the Automated Operation Span task (OSpan; Unsworth, Heitz, Schrock, & Engle, 2005) was used to assess working memory (WM) and cognitive capacity, and a section of Raven's Standard Progressive Matrices (RSPM; Raven, Raven, & Court, 1998) was used to measure Gf (Ward et al., 2017). In

fact, Gf is unrelated to previous knowledge, whereas crystallized intelligence (Gc) is related to acquired skills and academic abilities (Polk, 2016). Drawing upon this knowledge of outcome measures, the present study sought to understand whether cell-phone presence influenced the demonstration of pre-existing academic skills and abilities.

Research question and relevance. The study focused on whether the presence of a cell phone affected the demonstration of pre-existing sentence comprehension, spelling, and mathematics skills. To this end, it was essential to investigate this area of study and how it relates to learning. Evidently, students arrive at the start of the school year or the beginning of a term with pre-existing academic skills and abilities. Many of these skills and abilities are established prior to new material being taught and tested. Oftentimes, the development of new skills and abilities depends on the retention and demonstration of previous learning. To elaborate, scaffolding, originally labelled by Wood, Bruner, and Ross (1976) and related to Vygotsky's (1962) zone of proximal development (ZPD), is the process by which a new, emergent skill or piece of knowledge is taught and eventually applied. For example, A. L. McGrath frequently began her statistics lectures by reviewing introductory concepts that students needed to have a firm grasp on in order to comprehend the following information (personal communication, October 18, 2016). Because this type of new learning frequently depends on prior learning and because cell-phone presence has become increasingly common in learning environments today (thereby leading to the potential for increased distractions), it is important to consider how cell-phone presence may interfere with the demonstration of pre-existing skills and abilities. Common academic tasks (e.g., exam writing and completing review assignments) presumably involve the use of previously learned skills

and retained information, thus making this research relevant to instructors and students alike. Above all, this research could guide instructors in their decisions to allow or restrict phones in the classroom and policy makers would be more knowledgeable about the effects of cell-phone presence. Students would also be better equipped to make academic-related decisions that would ensure their demonstration of pre-existing skills.

Hypotheses. To recap, the present study manipulated the mere presence of a cell phone to see how cell-phone presence or absence affected the demonstration of pre-existing sentence comprehension, spelling, and mathematics skills. In order to answer the research question, among the achievement subtests developed by Wilkinson and Robertson (2006), three of four subtests (i.e., a sentence comprehension, spelling, and mathematics test) were relevant to the research question and were feasible for group administration used in the present study. When a personal cell phone was merely present, it was hypothesized that (1) the demonstration of pre-existing skills on a sentence comprehension subtest would be poorer in a cell-phone-present group compared to a cell-phone-absent group, (2) the demonstration of pre-existing skills on a spelling subtest would be poorer in a cell-phone-present group compared to a cell-phone-absent group, and (3) the demonstration of pre-existing skills on a mathematics subtest would be poorer in a cell-phone-present group compared to a cell-phone-absent group.

Method

Participants

Undergraduate students from Mount Royal University (MRU) and the general public ($N = 45$), ranging in age from 17.92 to 41.83, participated in the study ($M_{age} = 22.33$, $SD_{age} = 5.23$); all but two participants were from the introductory psychology pool

(see Appendix A for the recruitment advertisement and Appendix B for the recruitment poster). The sample consisted of female participants (n = 34), male participants (n = 10), and other participants (n = 1) who were randomly assigned to a cell-phone-present group (n = 23, M_{age} = 23.46, SD_{age} = 6.65) and a cell-phone-absent group (n = 22, M_{age} = 21.15, SD_{age} = 2.83). In order to meet inclusion criteria, participants' first language had to be English, and they could not have any known learning issues that would affect reading, writing, attention or mathematics. As well, participants were required to have access to a personal cell phone that had the potential to connect to the Internet, and they had to bring the cell phone with them on the day of testing. A few additional restrictions were in place; for instance, participants could not have signed up for any prior studies that had utilized the same literacy measures. For introductory psychology students, a total of 1% course credit was provided for participation. Participants from the general public were entered into a random draw for a $50 gift card for a place of the winner's choosing.

Materials

The Wide Range Achievement Test (WRAT-4) (Wilkinson & Robertson, 2006) was chosen for group administration; the subtests measured pre-existing ability in areas of sentence comprehension, spelling, and mathematics, and each subtest was a standardized and norm-referenced assessment with good psychometric properties (Dell, Harrold, & Dell, 2008). Dell et al. (2008) reported that the internal consistency ranged from .92 to .98 for the overall test, and a range of .87 to .93 was reported for the subtests.

Sentence comprehension subtest. In the original version, participants would receive a comprehension card with 50 fill-in-the blank sentences, and the researcher would have a testing form similar to an answer key (i.e., the testing booklet contained a

list of common correct and incorrect answers for each sentence). Participants would read each sentence on the comprehension card to themselves, and then they would speak a word that would complete the corresponding sentence. Following each answer, the researcher wrote the participant's response in the testing booklet. Due to group testing in the current study, the comprehension card was not used. Instead, a modified version of the sentence comprehension test provided the participants with the testing booklet, but the answer key (normally in plain view on the form) was covered up by coloured paper so participants could not see the answers. Sentences were read silently, and participants wrote their responses in the blank spaces in the booklet. The sentence comprehension subtest became progressively more difficult. An example of an easier sentence was as follows: "Leroy was in a hurry. He walked very _____," whereas a more difficult sentence was "The assistant librarian, who typically treated visitors very cordially, was surprisingly _____ when the architect requested help" (Wilkinson & Robertson, 2006). Twelve minutes were allotted for this subtest. For scoring, correct responses were assigned one point and incorrect answers were not. The higher the standardized score (i.e., based on a mean of 100 and a standard deviation of 15 for each age group), the greater the participant's pre-existing sentence comprehension skills.

Spelling subtest. The spelling subtest was comprised of 42 words. For each item, a researcher read a word from a spelling list, said the word aloud in a sentence, and then repeated the word. After each item was read, participants spelled the word on a response form. Similar to the sentence comprehension subtest, the words became increasingly more difficult as the subtest progressed. To illustrate, an easy spelling word was "cook" and a very difficult word was "pusillanimous" (Wilkinson & Robertson,

2006). On average, this test took about 5 to 6 minutes. Correct answers were awarded one point, whereas incorrect answers were not. The higher the standardized score, the better the participant's pre-existing spelling skills.

Mathematics subtest. A total of 40 mathematics questions were completed on a computation response form. Participants read the questions to themselves, and they recorded their answers on the form. As participants completed the subtest, the questions became increasingly more difficult. An easier question on Wilkinson and Robertson's (2006) test was "3 x 4," but a more challenging question was "Write as a fraction in simplest form: .075." Altogether, 15 minutes were provided for this subtest. Each correct answer was allocated one point, whereas incorrect answers were not. The higher the standardized score, the greater the participant's pre-existing math skills.

To administer Wilkinson and Robertson's (2006) Wide Range Achievement Test (WRAT-4), a few more modifications had to be done, and some supplementary materials were needed. Typically, the WRAT-4 consists of four subtests: word list reading, sentence comprehension, spelling, and mathematics. However, due to group testing, only the latter three assessments were used. Also, a sentence comprehension, spelling, and mathematics response form was required for each participant. Finally, the researchers used stopwatches to ensure that the timing of each subtest remained consistent; two identical boxes for cell-phone collection and seven paperback novels for deceptive manipulation were also made available.

Procedure

A visual overview of procedural steps can be viewed in Figure 1. The figure shows the general sequence of activities that participants completed. For further clarification of the procedure, the research assistant script is included in Appendix C.

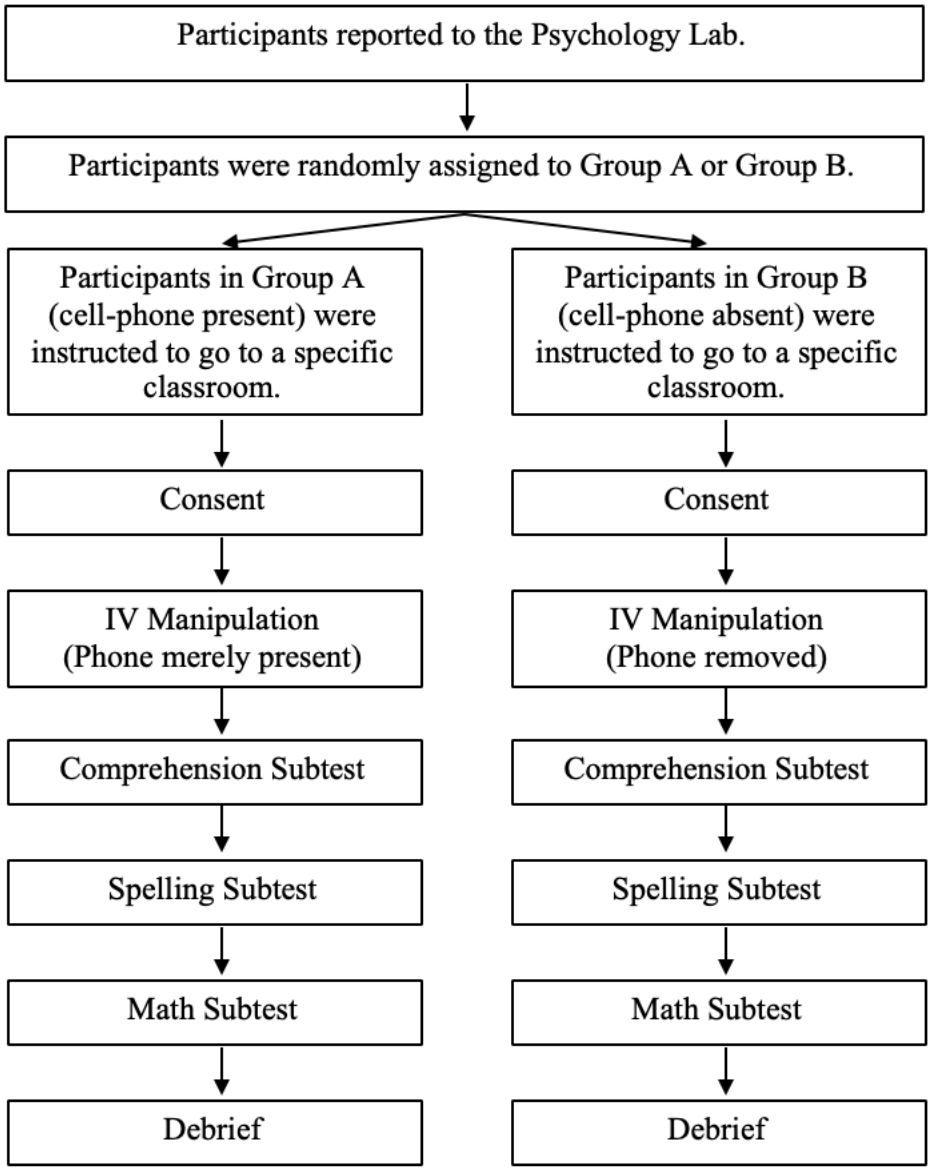

Figure 1. An overview of what participants did in the study.

Random assignment. The participants came to the Psychology Lab, and they were greeted by a research assistant. Participants drew a piece of paper, which had an "A" or "B" written on it, from a bag. This draw randomly assigned participants to Group A (cell-phone present) or Group B (cell-phone absent). Participants who were randomly assigned to Group A were instructed by the greeter to go a specific classroom, and participants who were randomly assigned to Group B were told to go to a different room. At this point in the study, neither group knew that cell-phone presence was being investigated. Only the researchers had this knowledge until the debriefing was given.

Consent and demographics. In the respective testing classrooms, an assistant was waiting to review the consent forms. To differentiate between introductory psychology students and the public, two different consent forms were used. Each group reviewed the appropriate consent form (see Appendix D and Appendix E). Participants thought that they would be performing tests of academic ability and then a social-media survey. After consent was obtained, each group filled in basic demographic information such as gender and age. Age-related information was needed for standardized scoring as required by Wilkinson and Robertson (2006).

Cell-phone presence or absence manipulation. Participants in Group A were told to turn off their cell phones and to place them on the desks in front of them, whereas participants in Group B were told to turn off their phones and temporarily surrender them. The greeter who assisted with random assignment also helped to gather Group B's phones using a collection box. After the collection, this assistant took a replica box (previously planted behind a computer podium) and removed it from the classroom. This gave the appearance that phones were removed from the room without ever leaving them

unattended. For the first three testing sessions the replica box was empty. However, in order to increase the realism of the manipulation during the following testing sessions, a research assistant placed one book (up to a maximum of seven books) in the replica box per expected participant. In other words, if three participants were expected to be in the cell-phone-absent group after random assignment had occurred, a total of three books would have weighed down the replica box.

Tests of pre-existing ability. Following the phone-presence or absence manipulation, participants completed the same tasks in the same order: sentence comprehension, spelling, and mathematics. Because the order of the tests is part of the standardization, counterbalancing was not used (Wilkinson & Robertson, 2006). When the subtests were finished, participants in Group A were told that they could use their phones again. Meanwhile, participants in Group B were told that their phones would be returned. The original box was removed from behind the computer podium, and the participants retrieved their phones.

Debrief. During the debriefing, participants learned about mild deception. That is, cell phones were not being used for a social-media survey or to investigate a relationship between ability and social-media use; rather, participants were assigned to Group A or B to investigate how cell-phone presence influenced the demonstration of pre-existing academic skills and abilities. Importantly, participants were asked not to divulge the deception to others who may participate in a later session. A copy of the debriefing form can be viewed in Appendix F, and Appendix G shows the ethics approval letter. After each testing session, the two researchers switched who administered the subtests to each cell-phone group. This was done to ensure that each researcher's unique

style of test administration did not influence the participants' subtest performance. In total, the study took approximately 60 minutes.

Data Analyses

Descriptive statistics, such as participants' mean age and the standard deviation of age, were calculated to determine participant demographics. Boxplots were generated to detect outliers (i.e., any point 1.50 times greater than the interquartile range), and scatterplots were used as a secondary, visual outlier screening method. Outliers beyond the acceptable area were removed from the analysis. Participants who failed to complete one or more of the subtests (i.e., they left an entire subtest blank) were not eliminated from the analysis; rather, only the individual subtest score (i.e., a score of zero) was eliminated. Means and standard deviations for each subtest were calculated to compare the demonstration of pre-existing skills between the two groups. To determine if the means on the sentence comprehension, spelling, and mathematics subtests were significantly different between the groups, three two-tailed *t*-tests for independent samples were performed. Following data collection, a retrospective power analysis was also done to determine the likelihood of detecting statistically significant effects (if such effects existed). On each subtest, when the treatment groups were compared, it was expected that a statistically significant difference in the demonstration of pre-existing skills would be observed.

Results

Preliminary Analyses

After the initial outlier check, six outliers were detected. Four of these outliers were detected in the cell-phone-present group, and the remaining two outliers were

observed in the cell-phone-absent group. In the cell-phone present-group, one extreme outlying value on the sentence comprehension subtest was removed from the final analysis because the participant failed to complete this subtest. On the spelling subtest completed by the same group, two scores were identified as outliers, so these values were removed. The final outlier in the cell-phone-present group was observed on the mathematics subtest, so it was excluded. Regarding the cell-phone-absent group, two scores on the spelling subtest were outliers, so these were also removed from the analysis. After the outlying scores were removed and boxplots revealed no new outliers, depending on the subtest, the number of participants in the cell-phone-present group ranged from 21 to 22; the number of participants in the cell-phone-absent group ranged from 20 to 22.

Descriptive Statistics and Independent Samples *t*-Tests

When a cell phone was present during testing, the demonstration of pre-existing skills on the sentence comprehension subtest ($M = 100.45$, $SD = 10.17$) was not significantly different from the cell-phone-absent group who also completed the sentence comprehension test ($M = 98.18$, $SD = 12.96$), $t(42) = 0.65$, $p = .52$, $d = 0.19$, 95% CI [-4.82, 9.36]. Based on this result, there was insufficient evidence to suggest that the demonstration of pre-existing sentence comprehension skills was poorer when participants were in the presence of a cell phone. Subsequently, when participants completed the spelling subtest in the presence of their cell phone ($M = 106.71$, $SD = 6.80$), the demonstration of pre-existing skills was not significantly different compared to a cell-phone-absent group ($M = 102.35$, $SD = 8.09$), $t(39) = 1.87$, $p = .07$, $d = 0.58$, 95% CI [-0.35, 9.08]. This suggested that when a participant's phone was merely present, the demonstration of pre-existing spelling skills was unaffected. That is, participants who

took the spelling subtest in the presence of their phone did not perform more poorly than participants whose phone was absent during this subtest. Lastly, when participants completed the mathematics subtest in the presence of their cell phone (M = 92.64, SD = 9.05), the demonstration of pre-existing skills was not significantly different than when participants completed the mathematics subtest in the absence of their phone (M = 88.32, SD = 8.49), $t(42) = 1.63$, $p = .11$, $d = 0.49$, 95% CI [-1.02, 9.66]. Considering this result, there was insufficient evidence to suggest that the demonstration of pre-existing mathematics skills was poorer when participants took this subtest in the presence of their phone. Unexpectedly, a trend was observed in the opposite direction. On each subtest, the mean of the cell-phone present group was higher than the mean of the cell-phone-absent group; albeit, the trend was non-significant even though the spelling subtest approached significance (i.e., p was between .05 and .10). Retrospective power reported for these t-tests was 9.70%, 44.72%, and 35.77%, respectively. Table 1 presents an overview of basic descriptive statistics, such as means and standard deviations for the groups and subtests, and it shows how the sample size per group and on each subtest differed depending on outlier removal.

Table 1

Descriptive Statistics for the Treatment Groups Per Subtest

	Group ($N = 45$)									
	Phone Present ($n = 23$)					Phone Absent ($n = 22$)				
Subtest	*n*	*M*	*SD*	Min	Max	*n*	*M*	*SD*	Min	Max
Comprehension	22	100.45	10.17	82.00	119.00	22	98.18	12.96	80.00	129.00
Spelling	21	106.71	6.80	90.00	117.00	20	102.35	8.09	88.00	119.00
Mathematics	22	92.64	9.05	72.00	111.00	22	88.32	8.49	70.00	104.00

Note. Sample sizes vary due to the removal of outlying scores on each subtest. Based on participants' age and birthdate, standardized sentence comprehension scores could range from 55 (i.e., a score of zero) to 132 (i.e., a perfect score), standardized spelling scores could range from 55 to 145, and standardized mathematics scores could range from 55 to 144.

Discussion

Participants took three subtests (sentence comprehension, spelling, and mathematics) to determine if their pre-existing skills on sentence comprehension, spelling, and mathematics were poorer in the presence or absence a cell phone. This manipulation was done for a few reasons. First, cell-phone presence has been prevalent in two recently-studied domains: (1) relationships (Allred & Crowley, 2017, Crowley et al., 2018; Lanette, 2018, Misra et al., 2016, and Przybylski & Weinstein, 2012), and the (2) learning-related and cognitive domain (Ito & Kawahara, 2017; Lyngs, 2017; Thornton et al., 2014; Urick et al., 2018, Ward et al., 2017). Next, all these studies examined cell-phone presence, but the outcome measures in the learning-related and cognitive domain were related to fluid intelligence. Its effects on crystallized intelligence remained to be explored; that is, until now.

In the present study, three predictions were made. When participants completed each subtest in the presence of their cell phone, the demonstration of pre-existing skills was predicted to be poorer on the (1) sentence comprehension subtest, the (2) spelling subtest, and the (3) mathematics subtest. Surprisingly, when the cell-phone present and absent groups scores were compared, there was no statistically significant difference in the demonstration of pre-existing skills on any of the tests except on the spelling test, where the between group comparison was marginally significant. Therefore, none of the hypotheses were supported. What was observed, however, was a non-significant mean difference in the reverse direction. When participants completed the subtests in the presence of their phone, the mean score was consistently higher than the other group.

Possible Explanations for the Findings

Phone restriction and anxiety. Thinking back to Clayton et al.'s (2015) study, participants experienced all sorts of adverse physiological responses (e.g., high blood pressure and heart rate) when they were unable to answer their nearby cell phones. In the present study, participants in the cell-phone-absent group were not told where their phones were supposedly taken, and they could not answer any incoming calls; they only knew that their phone would be returned after testing. Given the covert manipulation, it is reasonable to think that some participants in the phone-absent group had undesirable physiological responses (e.g., anxiety). In Cheever et al. (2014), cell phones were either taken away in exchange for a claim ticket or silenced and stowed in a non-visible place; both groups' anxiety increased with the passage of time. In comparison, the present study required participants in the phone-present group to keep their phones turned off, but the devices were still visible. Under these circumstances, participants in this group may have experienced less anxiety because, unlike the cell-phone absent group, their phone remained within arm's reach.

What a cell phone represents. Thornton et al. (2014) expressed that phones may be distracting because they represent omnipresent social networks. Granted that the cell-phone-present group outperformed the comparison group in the present study, when a cell phone is merely present, thinking about social networks may not be so detrimental after all. In Faizi et al.'s (2013) article, they conveyed that both learners and instructors can benefit from using social networks because both parties can learn from one another, work together, and achieve shared goals. Considering this information, some people likely use social networks to review course content with a peer or with a larger study

group, so instead of distracting some individuals, cell phones may remind individuals of prior learning that occurred using these networks. To that end, if the mere presence of a cell phone prompts students to think about their social network interactions which are occasionally associated with learning, the mere presence of a cell phone may be beneficial for individuals in some instances.

If a phone can potentially prime thoughts about social connectivity, another possibility remains: The mere presence of a cell phone may invoke thoughts related to cell-phone functions used for learning and academic tasks. With the exception of specific academic tasks, Przybylski and Weinstein (2012) alluded to more general ideas; they suggested that when a cell phone is present in a social setting, its presence evokes memories of people, places, and situations. Misra et al.'s (2016) article mentioned similar sentiments. Almost anyone who owns a cell phone recognizes they can be used for a plethora of academic-related activities such as taking notes, locating words in an online dictionary, and computing solutions to mathematics problems. Occasionally, participants in the present study asked if they could use their phone for solving the mathematics problems; obviously, they could not. That is to say, because this question arose, it is safe to assume participants could have been thinking about one or more academic tasks in the presence of their phone. With regard to this, the mere presence of a cell phone may have primed thoughts about previous learning that was accomplished with their phone. To put it another way, when participants completed the subtests, the phone's presence may have reminded them about academic tasks or information related to the subtest content. This reminder could explain why the cell-phone present group outperformed the other group.

Revisiting cell-phone use, attachment, and dependence. When a cell-phone-present and absent group were compared in Lyngs (2017), he did not observe significant differences in performance, yet participants who reported being highly attached to their phones found that a complex activity (i.e., an additive-cancellation task) required less effort when a phone was present. Likewise, the higher the reported use of and attachment to a cell phone, the more likely participants were to perceive the tasks as more enjoyable when completed in the presence of their phone (Lyngs, 2017). Following this logic, in Ito and Kawahara's (2017) study, participants who reported low Internet use and less Internet attachment were slower to perform a visual search. In the present study, if participants in the cell-phone-present group were truly more attached to their phones, perhaps they found the subtests more engaging and less tedious. It seems to be that attachment to one's phone or usage of the Internet may actually increase rather than impede performance when a phone is present. As Thornton et al. (2014) also mentioned, older participants were less attached and not as dependent on their phones compared to younger participants. It seems likely that the young participants in the present study could have been highly attached to their phones; this high level of attachment may have facilitated the demonstration of previously learned skills and existing abilities. Moreover, Lyngs (2017) noted that on a complex task, the phone-present group's mean score was higher than the phone-absent group's, but the difference was minimal (i.e., 0.20). There is no doubt that the subtest questions, administered in the present study, were intricate and predominantly challenging; when the study ended, one participant remarked that the researcher should have added a self-esteem measure! The more the

participants perceived the subtests to be complex, the greater the benefit of cell-phone presence may have been.

Context-dependent memory. Drawing upon noteworthy studies in the area of cognitive psychology, context-dependent memory informed the observed results. In one instance, Godden and Baddeley (1975) showed how recall is greater the more a testing environment is similar to the original learning environment. Another key study in this field revealed exam performance was enhanced when a match between the learning and testing context existed (e.g., reading an article in a noisy or silent condition and being tested in the presence or absence of noise) (Grant et al., 1998). Relatedly, individuals learn new skills and information through repeated practice sessions; during these tasks, a cell phone may be kept nearby for a "just in case" moment (e.g., receiving an unexpected incoming text or call). Even if individuals keep their phones on hand for anticipated use, they may not use their phone at all times or in every situation. All things considered, the context wherein participants in the present study practiced newly learned skills (which typically become well-learned after practice and therefore get relabelled as pre-existing skills) might have been similar to the environment wherein they completed the subtests. Because the cell phone provides familiarity in a variety of casual situations, it may increase the student's ease of demonstrating pre-existing skills in more formal settings. All in all, it becomes easy to see how the review and testing contexts are comparable.

Limitations

Random assignment. Unfortunately, the present study was not devoid of limitations. In principle, random assignment should have divided the two groups evenly, so the groups should have had approximately the same number of participants with low,

medium, and high ability. In actuality, it is possible that the groups actually differed in their previously learned skills and academic ability. Even after random assignment, the cell-phone present group could have actually had more participants with higher skills and ability than the cell-phone absent group.

Sample size. Akin to other studies, such as Urick et al.'s (2018) who only had 26 participants split between a cell-phone present and cell-phone absent group, and Ito and Kawahara (2017) who only had 40 participants divided amongst an experimental and control group, the small sample size in the present study was likely problematic. McGrath (2016), during an introductory statistics class, indicated that researchers should aim to collect samples with at least 30 participants per group. Generally, this is the agreed upon standard within psychology although a few exceptions exist (e.g., studying a distinct group of hard-to-come-by people such as cancer survivors or individuals with traumatic brain injury). Unfortunately, there were only 45 participants in the present study, so each group had less than the recommended minimum amount.

Statistical power. The between groups comparison for the sentence comprehension subtest revealed less than a 10% chance of detecting a significant result (if an effect existed). For the other two *t*-tests, there was less than a 50% likelihood of detecting an effect. Although this may, at first, appear alarming, Howell (2013) suggested that retrospective power is not typically a useful tool for describing non-significant findings. Rather, retrospective power is better related to an attained *p* value and vice versa and better suited for use as an evaluation tool for pre-existing research and can help guide psychologists in their decisions about future studies (Howell, 2013). As such, this type of power, calculated for this study, will be compared with prior research.

Analogous to Lyngs (2017), who indicated their sample size of 53 students might be inadequate for high power, the sample size in the present study was even smaller, so obtaining high power was also unlikely. Thornton et al. (2014) had comparable sample sizes: 54 participants in one experiment and 47 participants in another. Following this train of thought, after Lyngs (2017) conducted a retrospective power analysis on Thornton et al.'s results, it was determined that Thornton only had a moderate chance (i.e., greater than .50, but less than .80) of detecting a treatment effect. The present study had an even smaller sample size than both Lyngs and Thornton.

Manipulation check. Unlike prior studies, such as Lyngs (2017) whose participants wrote freely about what they thought the true nature of the study was, and Allred and Crowley (2017) whose participants were asked to recall what they remembered about cell-phone presence or absence, the present study had no manipulation check. Accordingly, it is possible that participants in the cell-phone absent group failed to notice the box being carried out of the room. Another possible problem with the manipulation was as follows: Some participants could have suspected mild deception. However, had there been a manipulation check, participants may have felt the need to respond in a desirable manner. To expand on this point, participants could have said they knew all along that the box being carried out was a replica box containing no phones even if they were clueless about this manipulation.

Assessment of multiple variables. To achieve parsimony, variables such as the frequency of cell-phone use and attachment to and dependence on cell phones were not assessed. This is in stark contrast to what other researchers have done; precisely, in the learning-related and cognitive domain, Thornton et al. (2014), Lyngs (2017), Urick et al.

(2018), and Ward et al. (2017) assessed participants' dependence on their phones, and Ito and Kawahara (2017) administered a test of Internet addiction to determine participants' phone use and degree of phone attachment. Other research, such as Bianchi Bosch's (2018) recently published thesis, not only assessed cell-phone usage and attachment, but it added a Fear of Missing Out (FoMO) Scale (Przybylski, Murayama, DeHann, & Gladwell as cited in Bianchi Bosch, 2018), which assessed anxiety and fear that individuals sometimes feel when they think about fun and exciting activities they cannot readily engage in due to their involvement with another task. As the present study omitted these measures, it was beyond its scope to determine if these variables caused the obtained results; presently, only speculation about their influence on and relation to the results is possible.

Applicability of the subtests. With a mean age of 22.33, the tests of ability may not have been well suited to such a young demographic. The WRAT-4, published by Wilkson and Robertson in 2006, is over a decade old. Reflecting on this information, the standardized scores on the subtests may not have generalized to a young, primarily undergraduate sample (especially considering the test was norm-referenced and likely to be outdated). A more recent version, the Wide Range Achievement Test, Fifth Edition, (WRAT-5) has become available for purchase (Wilkinson & Robertson, 2017). As York University's Psychology Resource Centre (2018) points out, the most recent subtests are reliable and the newer version includes up-to-date norms. Alas, a quick scan further down the page revealed the astronomical costs associated with purchasing new scoring and testing booklets (York University Psychology Resource Centre, 2018). Thus, Wilkinson and Robertson's (2017) WRAT-5 may not be affordable or feasible for use at

smaller, primarily undergraduate universities where funding is often limited. When it was time to order the new forms for the present study, beyond the few booklets that came with the latest kit, booklets needed for testing were unavailable (possibly due to their recent publication) so the older test version was used.

Future Directions and Conclusion

As Crowley et al. (2018) pointed out, technology-related norms have been changing over time. New norms related to cell-phone use and presence are likely to emerge, yet it can be difficult to form an agreed-upon set of guidelines for cell-phone use and for the less commonly explored subject of cell-phone presence within learning contexts. Namely, some instructors have tolerance for merely present cell phones in the classroom whereas others do not. Analogous to Bugeja (2007), who noted that some instructors have started to include technology policies on their course outlines, Grant (2018) wrote the following on her course syllabus: "I do not allow cell phone use in class. Cell phones must be kept on silent and not visible (e.g., in your bag)" (p. 8). Within the same department at the same university, another instructor holds a much different view. In E. F. Field's class, students were asked about the meaning of psychology terms; when they could not arrive at an answer, she encouraged students to take out personal devices to look up information (personal communication, September 19, 2018). Unlike Baker et al. (2012), who revealed that some academic institutions have started to create and enforce technology policies, the above examples reveal inconsistencies about what is labelled acceptable versus unacceptable. Based on the obtained results in the present study, it is difficult to say what the "right" stance to take on cell-phone presence in the classroom actually is. Perhaps, when cell phones are merely present, they may not

impede the demonstration of already learned skills after all; the presence of a phone may actually facilitate the demonstration of these skills. Arguably, more research on cell-phone presence is needed to make more informed decisions about these matters. With this in mind, and reflecting on the fact that cell phones are not the only devices that are typically present in learning environments, it is important to consider the effects that other technology, such as laptops or tablets (e.g., iPads) may have on learning and cognitive tasks.

Some researchers (Thornton et al., 2014; Ward et al., 2017) within the learning-related and cognitive-task domain have indicated that studying other merely present technology, along with investigating its potential to create distractions and lessen academic performance, is warranted. Following the completion of Thornton et al.'s (2014) study, the researchers speculated that some connective technologies, such as tablets, may lead to distractibility; in a like manner, Ward et al. (2017) suggested that future research ought to explore various technological devices used by a younger demographic (e.g., children and adolescents) in a classroom setting. As a matter of fact, some additional research (Fried, 2008; Jacobsen & Forste, 2011; Kraushaar & Novak, 2010; Ravizza, Uitvlugt, & Fenn, 2017; Sana, Weston, & Cepeda, 2013) beyond the scope of cell-phone presence, reveals that the use of technology (e.g., laptops) negatively affects learning. Sooner or later, the effects of technology's presence, not just cell-phone-related effects on learning and cognitive tasks, may one day be widely studied.

Unlike the emerging interest in studying other merely present technology, a great deal of research exists on cell-phone use in learning environments (e.g., Harman & Sato, 2011; Froese et al., 2012; Kuznekoff &Titsworth, 2013). In spite of this abundance,

fewer studies have investigated cell-phone presence and its impact. For that reason, future studies would benefit from manipulating cell-phone presence rather than solely exploring cell-phone use. Given that this was the first study of its kind to investigate the relationship between pre-existing skills and cell-phone presence, researchers should consider using outcome measures related to crystalized intelligence and not just fluid intelligence. What is more, future research can seek to increase sample size to not only improve power, but to develop more convincing arguments about the effects that cell-phone presence may have in a classroom or during a learning-related task. Future research can also attempt to design and utilize manipulation checks and other stringent procedural methods while concurrently assessing several variables (e.g., frequency of phone use, attachment to technology, or dependence on one's phone) and using up-to-date testing materials. Along with studying cell-phone presence and pre-existing skills, to inform and guide others (e.g., institutional policy makers), future research should track the progression of norms related to technology use and presence. To add, how the presence of technology influences the decisions that students and educators make, both within and outside of a classroom, also remains to be explored in greater depth. Undoubtedly, technology use and presence will have long-lasting consequences, so it important to know how to mitigate their harmful effects and maximize their benefits.

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Appendix A

SONA Recruitment

Study Information

Study Name: Academic Ability
Duration: 60 minutes
Percent: 1%
Description: 60 minutes
Eligibility Requirements: English as a first language; no known learning disabilities that affect reading, writing, attention, or mathematics; must have access to a personal cell phone with the ability to connect to the Internet
Preparation: Participants must bring a personal cell phone with them that has the ability to connect to the Internet

Restrictions

Sign-Up Restrictions:
Must NOT have signed up for ANY of these studies:

- Expectations and Performance on Academic Tasks in Cancer Survivors
- Phones
- Splrs
- Tracking Visual Attention in Unexpectedly Poor Spellers
- Unexpectedly Poor Spellers and Attention to Visual Detail

Additional Study Information

Participant Sign-Up Deadline: 24 hours before the study is to occur
Participant Cancellation Deadline: 24 hours before the study is to occur

Researcher Information

Researchers: Primary Researcher: Tru Kwong (E-mail: tkwong@mtroyal.ca)
Student Researcher: Vanessa Boila (E-mail: vboil640@mtroyal.ca)

Appendix B

Recruitment Poster for the General Public

Academic Ability

Student Research Study at Mount Royal University

Location: MRU's Centre for Psychological Innovation (EA2020)

Duration: 60 minutes

Testing Dates and Times:

Wednesday, February 27th, 2019 – 10:00 a.m. – 11:00 a.m.
Wednesday, February 27th, 2019 – 11:30 a.m. – 12.30 p.m.
Wednesday, February 27th, 2019 – 1:00 p.m. – 2:00 p.m.

Description: This study is designed to investigate the relationship between ability and social media exposure. You will be asked to complete a reading comprehension test, a spelling test, and a mathematics test. Finally, on your cell phone, you will be asked to complete a questionnaire about your exposure to various forms of social media (i.e., Facebook and Instagram).

Eligibility: English as a first language; no known learning disabilities that affect reading, writing, attention, or mathematics; must have access to a personal cell phone with the ability to connect to the internet.

Preparation: Participants must bring a personal cell phone with them that has the ability to connect to the internet.

Sign-up Restrictions: Must NOT have signed up or completed ANY of these studies at Mount Royal University: *Expectations and Performance on Academic Tasks in Cancer Survivors*, *Phones*, *SpIrs*, *Tracking Visual Attention to Unexpectedly Poor Spellers*, *Tracking Visual Attention to Letter Strings in Unexpectedly Poor Spellers*, and *Unexpectedly Poor Spellers and Attention to Visual Detail*.

Compensation: Participants will be entered in a random draw for a $50 gift card. The gift card will be for a place of the winner's choosing.

Sign-Up & Cancellation Deadline: 24 hours before the study

Sign-Up Info: If you would like to participate, please e-mail Vanessa at vboil640@mtroyal.ca. You do not need to be an MRU student to participate. However, if you are a current MRU student who is enrolled in introductory psychology, please sign up via the SONA system.

Academic Ability Study
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Appendix C

Research Assistant Script

Consent

(*Consent forms and WRAT4 testing booklets will be placed on desktops and labelled with a participant code (e.g., A01 or B01) before participants enter the room. Also, on the board in the classroom the following message will be written: Please do not open or write on any booklets until instructed to do so. The research assistant reviews consent with the participants when everyone is seated and ensures all of the consent forms are signed*).

Filling in Demographic Information

You will see two booklets on the desk in front of you. One says Blue Sentence Comprehension Form and the other says Blue Response Form. Please do not open these booklets until you are instructed to do so. We will begin by writing some information on each of the booklets. Listen carefully.

On the top of each booklet there is a blank space for you to write in your gender. You can find that section here. (*The assistant will hold up a form at the front of the room and point to the specific area*). Using the pen provided, please fill in your gender on the blank space next to the word, "Gender." Please *do not* put your name on any of the booklets.

Next, please fill today's date where it says date of test. I will write an example for you on the board. Please write the date of test on both booklets.

(*The research assistant will write the date on the board to be written directly on the forms such as 19-01-30*).

	Year	Month	Day
Date of Test	19	01	30
Date of Birth			
Age			

Next, below today's date, please fill in *your* date of birth where it says date of birth. I will write an example for you on the board, but please do not copy directly from the board. You will use your own birthday year, month, and day. Please write your date of birth on both booklets

(*The research assistant will write a sample birthday date on the board such as 1987-08-31*).

	Year	Month	Day
Date of Test	19	01	30
Date of Birth	87	08	31
Age			

Next, please listen carefully and then proceed. After I go through an example, you will fill in your age in years and months below the date of birth. You will do this by writing your age in years and then how many months old you are from that age. For example, if you were born on August 31st 1987 you would be 31 years old, so you would write 31 for your age in years. For the

months, because you were born in August and it's now about 5 months after your birthday, you would write 05 for the months. I will write an example for you on the board, but please do not copy directly from the board. You will use *your* own age in years and months. Please write your age on both booklets.

(*The research assistant will write the sample on the board 31-05*)

	Year	Month	Day
Date of Test	19	01	30
Date of Birth	87	08	31
Age	31	05	

Great, we are almost ready to begin.

Manipulating Cell-Phone Presence

Cell-phone-present condition instructions:
Before we begin, please turn off your cell phone, and place your phone on the desk in front of you. Your phone can be turned on when we are done all of the tests. I will let you know when we are finished.

Cell-phone-absent condition instructions:
Before we begin, please turn off your cell phone. My assistant and I will come around, and we will collect your phone. Please place your phone in the collection bucket. Your phone will be returned when we are done all of the tests.

Comprehension Test (Note: The following instructions have been modified from the WRAT-4 for group testing)

We will start by doing a comprehension practice together as a group. I will read a sentence to you. Your job is to think about what word goes in the blank. Listen carefully**: "During the heavy rains last week, several trees were damaged when they were BLANK by lighting." What word goes in the blank? (Pause). OK, "hit" and "struck" are both correct. Sometimes more than one word can complete the meaning of the sentence correctly. Choose the first one that comes to mind.**

Now I will read another sentence. **"The woman decided that she did not want to keep the expensive watch, so she took it back to the store where she bought it and asked the manager to BLANK her money." What word goes in the blank? (Pause). OK, "refund" and "return" are two possible answers. Two short words used together like "give back" will also complete the sentence correctly, but both words have to be used because neither word by itself will complete the meaning of the sentence correctly.**

When I tell you to start, you are going to read sentences to yourself in the Blue Sentence Comprehension Test Form booklet and you will write your responses as clearly and as neatly as possible in the fill-in-the-blank space. **Read each sentence to yourself carefully and try to think of ONE word that completes the meaning of the sentence. If you can think of two words like "give back" in the sentence we just did, you may** write **them.** When I tell you to begin, you will have 12 minutes to complete up to 50 fill-in-the-blank questions. If you finish early, please wait silently until more instructions are given. Do you have any questions before we begin? You may now open your Blue Sentence Comprehension Test Form booklet and begin.

Time is now up. Please put your pen down and close the booklet. You may not open this booklet again at any point during the testing.

Spelling Test

Next, I would like you to take the other booklet that says Blue Response Form and flip it over to the back page, but do not open this booklet. At the top of the page, it should say SPELLING SUBTEST (*the research assistant holds up a blank copy of the form*). I am going to read some words to you and I would like you to write or print each one as clearly and as neatly as possible on the line beside the numbered space. Listen carefully so that you hear each word I say. Then, try to spell the word correctly. I will say the word, then read a sentence with the word in it, and then say the word again. Please write the first word on the line labelled 1 (*the research assistant will hold up a blank form and point to the area*) and then go down the page this way (*again the research assistant will demonstrate by pointing to a form at the front of the room*) as I say each word. Try to do your best. If you are not sure how to spell a word, you may take a guess. Do you have any questions before we begin?

(*The research assistant reads from each word from the spelling list on a card, says the word in the sentence written on the spelling card, and then says each word in a sentence again*).

Great, please put your pens down and listen carefully.

Mathematics Test

Next, I would like you take the same booklet you just completed the spelling test on and flip it over (*the research assistant demonstrates*). You should now be back to the page that says Blue Response Form. When I tell you to begin, you will open this booklet and you will have 15 minutes to complete up to 40 math questions. If you finish early, please wait silently until more instructions are given. Do you have any questions before we begin? You may now open your Blue Response Form booklet and begin.

Time is now up. Please put your pen down and close the booklet.

(*The research assistant collects all test booklets*).

Now that we are finished the tests, (you may use your cell phones/I will return your cell phones in a moment).

(The research assistant hands out the debrief form and reviews the debriefing form with participants).

Appendix D

Consent Form for the Psychology Students

RESEARCH CONSENT FORM

Project Title: *Academic Ability*

Investigators: *Vanessa Boila, B.F.A., B.Ed.;*
Mount Royal University Student, Department of Psychology

Tru Kwong, Ph.D.;
Mount Royal University Professor, Department of Psychology

Contact Information: *Phone: 403-440-8537*
Email: vboil640@mtroyal.ca or tkwong@mtroyal.ca

You are being invited to participate in a research project, as described above and in this consent form. Please note this consent form serves to provide an overview of what the research in question is about and what your participation would entail; it is only one part of the consent process. Read this consent form carefully. If you have any questions, please ask for help. You will receive a copy of this form.

Summary of the Study:

The purpose of this study is to investigate spelling, reading comprehension, and mathematics achievement and its relation to social-media use. Please do not participate in this study if English is your second language or if you have been diagnosed with a learning disability that affects reading, spelling, attention, or mathematics. Any of these things may affect your performance on these tasks.

Participant's Involvement/ What would my involvement entail?

Your participation involves a few short, separate tasks. These tasks include measures of literacy and mathematics achievement. For example, there are three tasks: timed reading-comprehension, a standardized spelling test, and a timed mathematics test. Finally, you will complete a brief survey on your cell phone investigating your exposure to social media (e.g., how much you use or do not use Facebook). Your participation should take approximately 40-60 minutes.

Collection of Personal Information/ What sort of personal information would be collected and how?

Your gender and date of birth will be requested when you complete the spelling, reading, and math tests. Gender will be used to report basic demographics of the participant group. Your

date of birth will be used for to report demographics and to calculate standardized scores for the spelling, comprehension, and math tasks.

The primary investigator and research assistants will have access to this information, but it will not be connected with your name, which will be on the consent form only. All other tasks will be recorded with a code that will identify them as belonging to the same participant; these will contain no identifying information other than your gender and date of birth.

Your comprehension, spelling, and math tests, your online survey, and your consent form, will be stored in a locked cabinet in the primary investigator's office. They will be destroyed after 5 years. Following participation, data will be recorded digitally and stored in a password-protected document on a password-protected computer. This document will contain no identifying information and will be deleted after 5 years.

Study Risks or Benefits for Participants/What are the risks or benefits involved in my participation?

This research can potentially contribute to the advancement of knowledge about undergraduate student achievement on comprehension, spelling, and mathematics tests and social-media use. The risks associated with this study are minimal. If you experience distress as a result of this study, please inform the researcher immediately. In the event that you suffer injury as a result of participating in this research, no compensation will be provided to you by Mount Royal University or the researchers. However, you still have all of your legal rights and nothing said in this consent form alters your right to seek damages. This study has been approved by Mount Royal's Human Research Ethics Board.

Voluntary Participation and Withdrawal of Consent:

You are under no obligation to participate in this research study. You are free to withdraw at any point during the study by simply saying you do not wish to continue. The tester will allow you to withdraw without prejudice and will not refer to pre-existing entitlements. You will not suffer any disadvantage or reprisal for withdrawing, and you will still get your 1% research credit. Please note that you will not be able to withdraw your data after you have completed the study and left the testing room. Because all of your data is anonymous, it will not be possible to identify it after you have left the testing room. If you choose to withdraw, any data already collected will be destroyed.

You will be given, in a timely manner throughout the course of the research project, information that is relevant to your decision to continue or withdraw from participation.

What will happen to the results of this research project?

Aggregate (combined) information may be reported as part of a research presentation or journal article. It may also be used for future research, still in aggregate form. Individual data will not be reported or made public in any way. You also will not be given feedback about your individual performance on any of these tasks.

Compensation:

You will receive 1% course credit for your participation in this study.

Who should I contact if I have concerns regarding ethical issues related to this research project?

If you have any questions concerning your rights as a possible participant in this research, please contact the Research Ethics Officer, at Mount Royal University, 403-440-8470, hreb@mtroyal.ca.

Signature (written consent):

Your signature on this form indicates that you:

- are voluntarily consenting to participate in this research project,
- understand to your satisfaction the information regarding your participation in the research project and your agreement to participate,
- have not yet commenced participation in the research project – your participation will only begin once you have provided your consent, and
- have been given adequate time and opportunity to:
    - consider the information provided,
    - pose any questions you may have, and
    - discuss and consider whether you will participate.

If you have further questions concerning matters related to this research, please contact Vanessa Boila, vboil640@mtroyal.ca, or Tru Kwong, Department of Psychology, Faculty of Arts, 403-440-8537, tkwong@mtroyal.ca

Participant's Name	Signature and Date
Principal Investigator/Delegate's Name	Signature and Date

The Human Research Ethics Board of Mount Royal University has approved this research study.

A copy of this consent form has been provided to you for your records and reference.

Appendix E

Consent Form for the General Public

RESEARCH CONSENT FORM

Project Title: *Academic Ability*

Investigators: *Vanessa Boila, B.F.A., B.Ed.;*
Mount Royal University Student, Department of Psychology

Tru Kwong, Ph.D.;
Mount Royal University Professor, Department of Psychology

Contact Information: *Phone: 403-440-8537*
Email: vboil640@mtroyal.ca or tkwong@mtroyal.ca

You are being invited to participate in a research project, as described above and in this consent form. Please note this consent form serves to provide an overview of what the research in question is about and what your participation would entail; it is only one part of the consent process. Read this consent form carefully. If you have any questions, please ask for help. You will receive a copy of this form.

Summary of the Study:

The purpose of this study is to investigate spelling, reading comprehension, and mathematics achievement and its relation to social-media use. Please do not participate in this study if English is your second language or if you have been diagnosed with a learning disability that affects reading, spelling, attention, or mathematics. Any of these things may affect your performance on these tasks.

Participant's Involvement/ What would my involvement entail?

Your participation involves a few short, separate tasks. These tasks include measures of literacy and mathematics achievement. For example, there are three tasks: timed reading-comprehension, a standardized spelling test, and a timed mathematics test. Finally, you will complete a brief survey on your cell phone investigating your exposure to social media (e.g., how much you use or do not use Facebook). Your participation should take approximately 40-60 minutes.

Collection of Personal Information/ What sort of personal information would be collected and how?

Your gender and date of birth will be requested when you complete the spelling, reading, and math tests. Gender will be used to report basic demographics of the participant group. Your

date of birth will be used for to report demographics and to calculate standardized scores for the spelling, comprehension, and math tasks.

The primary investigator and research assistants will have access to this information, but it will not be connected with your name, which will be on the consent form only. All other tasks will be recorded with a code that will identify them as belonging to the same participant; these will contain no identifying information other than your gender and date of birth.

Your comprehension, spelling, and math tests, your online survey, and your consent form, will be stored in a locked cabinet in the primary investigator's office. They will be destroyed after 5 years. Following participation, data will be recorded digitally and stored in a password-protected document on a password-protected computer. This document will contain no identifying information and will be deleted after 5 years.

Study Risks or Benefits for Participants/What are the risks or benefits involved in my participation?

This research can potentially contribute to the advancement of knowledge about achievement on comprehension, spelling, and mathematics tests and social-media use. The risks associated with this study are minimal. If you experience distress as a result of this study, please inform the researcher immediately. In the event that you suffer injury as a result of participating in this research, no compensation will be provided to you by Mount Royal University or the researchers. However, you still have all of your legal rights and nothing said in this consent form alters your right to seek damages. This study has been approved by Mount Royal's Human Research Ethics Board.

Voluntary Participation and Withdrawal of Consent:

You are under no obligation to participate in this research study. You are free to withdraw at any point during the study by simply saying you do not wish to continue. The tester will allow you to withdraw without prejudice and will not refer to pre-existing entitlements. You will not suffer any disadvantage or reprisal for withdrawing, and you will still get your 1% research credit. Please note that you will not be able to withdraw your data after you have completed the study and left the testing room. Because all of your data is anonymous, it will not be possible to identify it after you have left the testing room. If you choose to withdraw, any data already collected will be destroyed.

You will be given, in a timely manner throughout the course of the research project, information that is relevant to your decision to continue or withdraw from participation.

What will happen to the results of this research project?

Aggregate (combined) information may be reported as part of a research presentation or journal article. It may also be used for future research, still in aggregate form. Individual data will not be reported or made public in any way. You also will not be given feedback about your individual performance on any of these tasks.

Compensation:

Participants will be entered in a random draw for a $50 gift card. The gift card will be valid for a place of the winner's choosing.

Who should I contact if I have concerns regarding ethical issues related to this research project?

If you have any questions concerning your rights as a possible participant in this research, please contact the Research Ethics Officer, at Mount Royal University, 403-440-8470, hreb@mtroyal.ca.

Signature (written consent):

Your signature on this form indicates that you:

- are voluntarily consenting to participate in this research project,
- understand to your satisfaction the information regarding your participation in the research project and your agreement to participate,
- have not yet commenced participation in the research project – your participation will only begin once you have provided your consent, and
- have been given adequate time and opportunity to:
    - consider the information provided,
    - pose any questions you may have, and
    - discuss and consider whether you will participate.

If you have further questions concerning matters related to this research, please contact Vanessa Boila, vboil640@mtroyal.ca, or Tru Kwong, Department of Psychology, Faculty of Arts, 403-440-8537, tkwong@mtroyal.ca

Participant's Name	Signature and Date
Principal Investigator/Delegate's Name	Signature and Date

The Human Research Ethics Board of Mount Royal University has approved this research study.

A copy of this consent form has been provided to you for your records and reference.

Appendix F

Debriefing Form

Participants' Debriefing:
The Mere Presence of a Cell Phone and Academic Ability

Purpose. I am interested in whether the presence or absence of one's cell phone affects the demonstration of pre-existing academic skills. As a result, the study was titled *The Mere Presence of a Cell Phone and Academic Ability*, but it was called *Academic Ability* in the consent form and on SONA. Also, there was no survey about social-media use. Mild deception was used in this manner so that (1) participants would bring a personal cell phone for the study, so random assignment to a group (e.g., cell-phone present or cell-phone absent) was possible, and so (2) participants would not know the research question beforehand. Knowing the true purpose beforehand may have influenced test performance. For example, a cell-phone-present group may have altered their behaviour to conform to expectations of poor performance on the tasks. Therefore, I kindly ask that you do not reveal the true nature of this study to others (i.e., a classmate) who might become a participant in the future.

My hypothesis is that participants who complete the comprehension, spelling, and math tests in the presence of a cell phone will perform significantly worse than a cell-phone-absent group. Again, I expect that a cell-phone-present group will have poorer performance than a cell-phone-absent group.

Background. Previous studies have indicated that the mere presence of a cell phone reduces relationship quality during relationship-forming tasks, lowers attention and performance on complex tasks, and decreases working memory capacity (WMC) and fluid intelligence (Gf). As well, research suggests that cell phones, even when present and not in use, serve as a reminder of one's social network, thereby creating a distraction. However, it's unclear whether the mere presence of a cell phone has detrimental effects on the demonstration of pre-existing academic skills and ability. This study aims to determine if the manipulation of cell-phone presence influences the demonstration of pre-existing ability.

Design. Tests in reading comprehension, spelling, and mathematics were used to demonstrate pre-existing academic ability in these areas. Participants were randomly assigned to either a cell-phone-present group or a cell-phone-absent group. In the cell-phone-absent condition, cell phones were turned off, collected, and then stored in the testing room. An assistant collected a replica box that looked exactly like the cell-phone collection box, and removed it so participations would think that cell phones were no longer present. This manipulation was done because research suggests that when cell phones are physically present in a room performance may still be hindered. As well, the manipulation ensured that the phones were in a secure place at all times. This study is experimental; that is, all participants received the same achievement tasks, but were assigned to one of the two abovementioned cell-phone groups.

Contacts. Thanks very much for participating. Without the help of people like you, we couldn't answer most scientific questions in psychology. You've been a great help. If you have any questions, you may ask now or later by contacting Vanessa Boila by email at vboil640@mtroyal.ca, and/or Dr. Tru Kwong at 403-440-8537 or by email at tkwong@mtroyal.ca. Also, if you would like the results of this study, you can contact Dr. Kwong after April 15, 2019. If you have any questions regarding the ethics of this study, please feel free to contact the Research Compliance Officer, at Mount Royal University, 403-440-8470, hreb@mtroyal.ca.

Appendix G

Ethics Approval Letter

MOUNT ROYAL UNIVERSITY
1910

Human Research Ethics Board

t: 403.440.8470 | f: 403.440.6299
e: hreb@mtroyal.ca
research.mtroyal.ca

December 7, 2018

Tru Kwong and Vanessa Boila
Psychology
Mount Royal University

Dear Dr. Kwong and Ms. Boila

Re: Application Number 101580
The Mere Presence of a Cell Phone and Academic Ability

The above-noted honours thesis application was reviewed by the Human Research Ethics Board (HREB) and was found to be ethically acceptable on ***December 6, 2018***. I am pleased to advise you that ethical clearance for this proposal has been granted to **December 6, 2019**. You may request an extension if you wish to collect data beyond this date.

Please note that this clearance is contingent upon adherence to the limits of the project as outlined in your application, including the restriction of the student projects to minimal risk, and the appropriate education being provided to students regarding ethical conduct of research involving human participants. Prior permission must be obtained from the Board before implementing any substantive modification(s) to the submitted documentation.

Researchers are required to notify the Mount Royal University HREB immediately if any untoward or adverse event occurs during the student projects, or if data analysis or other review reveals undesirable outcomes for participants or the students. HREB and Mount Royal University adhere to the Tri-Council Policy Statement, "Ethical Conduct for Research Involving Humans".

You are required to submit a brief project completion report by **December 2019**. Completion report templates are available on-line under the "events" tab at the following link:
https://mru.researchservicesoffice.com/Romeo.Researcher/Login.aspx?ReturnUrl=%2fROMEO.Researcher%2f

Please accept the Board's best wishes for success with this project.

Yours sincerely,

Cynthia Gallop, PhD
Chair, Human Research Ethics Board

Cc. Department Chair

4825 Mount Royal Gate SW, Calgary, Alberta, Canada T3E 6K6

Appendix H

Personal Reflection

The Tumultuous Development of an Everchanging Research Project

A Reflective Essay for the MRU Library Award for Research Excellence Application

by

Vanessa Boila

When I began my project, I had no idea it would undergo so many changes. My initial project, with my original supervisor, focused on statistics anxiety reduction. However, each research design I proposed was rejected. One day, my supervisor supplied a pre-existing study she designed. Feeling disconnected from the design process, I was unable to immerse myself in this research, so I told my supervisor I was not committed to the study. Days later, she said she could no longer supervise the project. In that moment, I thought about quitting the honours program; it was a few days shy of October, and I had no research topic or supervisor. Fortunately, Dr. Kwong expressed her willingness to supervise my research.

Once I digested these events, I refocused my project's direction. Not knowing where to start, I browsed Dr. Kwong's online faculty profile and noticed she published a study related to text messaging, so I immediately conducted a search in PsycINFO using a rather unsophisticated strategy. That is, I began typing random words related to text messaging in a search box. Nevertheless, I stumbled upon a study that investigated cell-phone presence. The following morning, I began scrolling through magazine articles on the Psychology Today website. The next thing I noticed was a link to a trending article,

which suggested cell-phone presence may diminish cognitive capacity. After reading the publication, it dawned on me . . . cell-phone presence is a relevant and emerging topic of study. Before long, I became curious about existing cell-phone-presence research, and because I previously worked as a teacher, I wondered if research on laptop presence (particularly in learning environments) exists too.

Developing the research question was nothing short of a tumultuous journey. After conducting an initial search on laptop presence using academic journals (e.g., PsycINFO) and Google Scholar, I could not find any articles on the topic, which suggested a gap in the literature. Around the same time, due to volunteering in an on-campus research position, I became familiar with a variety of standardized tests, so I thought I might be able to use the tests in my study. Therefore, my preliminary question was formed: Does the mere presence of a laptop affect academic achievement on tests of comprehension, spelling, and math? With a question formulated, I submitted the project to the Human Research Ethics Board (HREB); unfortunately, when I received a response, the comments did not contain the glowing reviews I had hoped for. Instead of receiving ethics approval, my reviewer suggested research on laptop presence existed, the achievement tests I planned to use were not well aligned to the topic of laptop presence, and no prior study I referenced in my ethics submission used the same outcome measures I intended to use. Despite feeling disheartened, I pondered what to do next.

After much consideration, I took steps to steer my project in the right direction. To ensure the usage of credible sources and improve my search strategies, I contacted a campus librarian. In this meeting, although no studies directly related to laptop presence were located, my learning experiences were undeniably rich: I reviewed search strategies

(e.g., using the PsycINFO thesaurus) taught in introductory courses, learned new approaches (e.g., searching for researchers who had cited a particular article), and switched the focus of my study from laptop presence to cell-phone presence when I realized peer-reviewed studies on the topic of cell-phone presence existed. Next, Dr. Kwong suggested reviewing cell-phone-presence literature and listing previously used outcome measures. After charting the information, I detected a pattern; previous studies that manipulated cell-phone presence utilized measures of fluid intelligence rather than crystallized intelligence. This insight helped to explain the use of chosen achievement tests and finalize the research question: Does the mere presence of a cell phone affect the demonstration of pre-existing comprehension, spelling, and mathematics skills? Irrespective of the turbulent start, my progress had surpassed that of students who did not change supervisors or topics. Nevertheless, I revised my project further to ensure my best effort.

Throughout the research process, I used additional resources offered by the Riddell Library and Learning Centre (RLLC). To enhance my writing, I attended editing workshops offered by Student Learning Services (SLS). At the Long Night Against Procrastination (LNAP), I discovered SLS was offering free writing sessions. To my surprise, I was introduced to a database of collocations and discovered students could book SLS sessions throughout the term. With this new knowledge, it was not long before I began booking sessions regularly with a strategist. Having an external reader helped to identify areas of confusion in my writing; with a few modifications, readers who were less familiar with psychology could understand my project. When a strategist was unavailable and citing a less commonly used source (e.g., a dissertation, an academic

poster, or conference proceeding) using the APA Manual presented a challenge, I referred to Mount Royal University's (MRU) online referencing guide or used the online "Ask Us" chat service. Moreover, when it was time to complete my statistical analysis, I realized my subscription for a statistical software program had expired. This is when service staff introduced me to the Data Hub. Using the abovementioned resources, I finished my honours program and graduated in Fall 2019 with a completed research project I was proud to call my own.

During this project, I learned more about my exceptional resilience and ability to adapt to the everchanging research process than I ever imagined. For example, I learned research is rarely, if ever, a linear journey, and I discovered how generating research topics can originate from unconventional sources. Furthermore, I realized I must choose topics I am exceptionally passionate about for future research endeavours and work with supervisors who emphasize independence over conformity. Ultimately, and perhaps most importantly of all, I could not have completed my thesis without the support of others. As an age-old proverb goes, "It takes a village to raise a child," but I now believe it takes a village to complete a research project.